Sketches from Partial Memories

Ernst von Glasersfeld • University of Massachusetts • evonglas@hughes.net

> Purpose • In the forthcoming book *Partial Memories*, Ernst von Glasersfeld presents a chronological patchwork of autobiographical memories. *Constructivist Foundations* selected six of the 92 sketches to provide a preview of this book. **> Content** • The selected sketches cover the 1930s, when von Glasersfeld became interested in epistemology, and the 1970s, when he found experimental and argumentative support for his radical constructivism. **> Implications** • The colorful life of von Glasersfeld gives an impression of how many turns it has taken him to construct his insights.

Preface by Alexander Riegler

In the forthcoming book *Partial Memories*, Ernst von Glasersfeld looks back at his long and colorful life, which not only let him coin the term "radical constructivism" some 35 years ago but which also made him condense his experiences into his well-known epistemological attitude. Since the book will officially not appear before January 2010, Anthony Freeman, of the publishing house, Imprint Academic, generously granted permission for *Constructivist Foundations* to publish some of the 92 sketches from the book.

The first sketch takes us back to 1936 when, before leaving for Australia as a ski instructor, von Glasersfeld became interested in epistemology. Soon after that, in 1939, he discovered the philosopher Giambattista Vico, who would play an important role in his philosophy. In the third sketch he tells us about the language experiments with the chimp, Lana, which made von Glasersfeld want "to find out how Lana organized her experiential reality." In another sketch he describes his experiences of teaching at the University of Georgia in the early 1970s; later on, they would greatly shape the influence radical constructivism has had on education science. As von Glasersfeld writes, one of the things he had in common with Paul Watzlawick (and that led to his claim that an individual constructs his or her reality) is their polyglot mind, which enabled them to "live" in more than one language. Finally, in the last sketch we catch a glimpse of von Glasersfeld's ways of reasoning when, in 1978, already well acquainted with the work of Piaget and Berkeley, he reflected on space and time. In the book many more chapters can be found that are of great interest to the constructivist-minded reader, such as his acquaintance with Heinz von Foerster and Paul Watzlawick, to name but a few.

The subtitle of the book, *Sketches from an Improbable Life*, indicates that describing such a long life must necessarily be incomplete. However, this collection of sketches is a very motley patchwork; it provides the reader with an understanding of how many turns it has taken Ernst von Glasersfeld to develop his profound constructivist insights, which, thanks to his clear writing style, read so deceptively easily.

1937 Escape to Australia

When I arrived in Vienna in September 1936 and went to inscribe myself at the university, I got a foretaste of what was to come. Every now and then there were two or three young men with crew cuts, nondescript breeches, and high boots marching along a corridor, trying hard to look like soldiers. While waiting at the office of admissions, I asked the chap beside me what was going on.

"They're our Nazi colleagues preparing for the glorious future," he said.

I thought he was being sarcastic, but I wasn't sure – and this uncertainty became the dominant feature of my stay in Vienna. More than once I noticed that acquaintances, who had always put on a cosmopolitan air, surreptitiously showed others the Swastika badge they were wearing under the lapel.

An older school companion from Zuoz, an Austrian American, who was studying chemistry at Vienna, had a largish apartment in a suburb and suggested that I share it for half the rent. A great solution, as it turned out, because we had very different timetables and hardly ever got in each other's way. I had brought a whole case of spaghetti from home and that saved us from starvation several times when we ran out of money.

The situation at the university was steadily deteriorating. The sporadic marching of booted individuals developed into more or less organized demonstrations and when that happened, some of the professors would decide to go home. They had my sympathy and I did the same and went less and less to lectures and seminars that were not certain to take place. Instead I devoted much time to reading. The friend with whom I shared the apartment had finished high school at Zuoz two years before me and had a wide circle of friends in Vienna. Among them was a couple of older students who had an interest in philosophy and often talked about the Vienna Circle. (Heinz von Foerster, who knew practically all the members of that group when he was a student, later told me that it was misleading to speak of the Vienna Circle as a school of philosophy, it was much more like a discussion group.) The only name my friend's friends mentioned was Wittgenstein and that was how I first heard of his *Tractatus*. As I have written in other places, I understood practically nothing of that book, but I was intrigued by the aphoristic style and it certainly did not put me off philosophy. At the time, however, I learned much more from Bertrand Russell's *Problems of Philosophy* and, wanting to start from the beginning, I bought a copy of Hermann Diels' *Fragments of the Pre-Socratics*. In between I kept returning to the *Tractatus* and one day it became clear to me that Wittgenstein suggested something that was quite

http://www.univie.ac.at/constructivism/journal/5/1/055.glasersfeld

impossible. In order to find out whether a picture was true or false, he wrote, we had to compare it with reality. But this is a comparison we cannot make because whatever we may consider reality is a picture we ourselves make of it. It was more than enough to nourish my interest in what knowledge was and how we came to have it.

At the same time, an evening's conversation made me curious about Freud. I bought a copy of his *Analysis of Dreams* and when someone told me that Freud was going to give a public lecture, I went to hear him speak. I was greatly impressed. What, in retrospect, had the greatest impact on me was an assertion that was soon forgotten by many psychoanalysts. Freud said that a valid analysis of a dream could be produced only by the dreamer; the associations that linked an underlying meaning to the manifest surface of the dream were the dreamer's and not anyone else's. It was the first suggestion of mental construction I had come across and it was a thought that I never let go.

What Freud said was the first suggestion of mental construction I had come across and it was a thought that I never let go

As the end of the year came nearer, I thought a lot about what I should do. I had no intention of continuing at the University of Vienna, but there did not seem to be an alternative. I thought of returning to Exeter, but was pretty sure that financially it was not an option. There was also the problem of my passport. When I was born, my father was cultural attaché at the Austrian embassy in Munich. His property was in Prague, and when, after the First World War, Czechoslovakia was created, he automatically became a Czech citizen – and so did I. This meant that I would have to do military service in Czechoslovakia. It had already been postponed while I was studying in Zürich, but my passport was going to expire in about a year. Once that happened, I was afraid, there would be no escape.

Then I had a big stroke of luck. The Australian Ski Club – none of us had ever heard of people skiing in Australia – wrote to the European Ski Federation (FIS) that in order to advertise the ski-resort at Mount Kosciuszko they wanted to hold an international championship and were offering free passage to and from Sydney combined with a stay for three months to skiers who were ready to teach skiing for that period and enter the races at the end of it. The people at FIS were no doubt intrigued by the idea but they immediately saw a problem. The skiers who won races during the winter in those days did not ski all the year. They worked during the summer, mostly on farms, and could not afford to go to Australia just for skiing. So someone had the bright idea of writing to the few ski clubs that regularly sponsored racing, to find out whether there were any students who might be expected to do reasonably well in a race. That is how my name came up. I jumped at the opportunity. A Scandinavian Club nominated three young men, and Dick Durrance, who had spent most of his life in the Alps and was the only competitive skier in the United States, formed an American team with two of his colleagues from Dartmouth College.

None of the others accepted the teaching assignment, but their clubs made some arrangement with the Australians about financing the trip. I was thrilled with the idea and it was the first thing I told my mother when I returned from Vienna. I had written home about the Nazi demonstrations and the dismal situation at the university and I was sure that my parents would agree that there was no point in staying there. But my mother's reaction was still an unexpected one.

"Didn't you know," she said, "that the two sons of the Flexenhotel, where we have stayed in Zürs, have spent several summers teaching skiing in Australia and New Zealand? Anna Skardarasy, their mother, told me that she was planning to go out with them next summer. It's a great idea and now that you are going, I think I'll come along."

I was stunned. She used to leave my father alone at home quite frequently for a week or two – but to go to Australia for three months?

"Do you realize that this means going away for almost six months?"

"Oh, I wouldn't stay more than two or three weeks. I'd come back with Anna."

I remained a little uneasy. Not because of my father. I knew very well that he didn't mind being alone. He spent most of his time in his darkroom anyway. But I was still young enough to fear that traveling with a mother would be an impediment. Somewhere, of course, I knew that this was silly. After a few days on board I realized that, if anything, it was an advantage. My relation with the Skardarasy brothers, who were several years older than I, developed more easily because we had our mothers with us: it stopped them from patronizing me as a teenager.

The only thing I remember clearly from the seven-week journey is the stop at Colombo in Ceylon (now Sri Lanka). I was bowled over by the way people there moved. Even old men and women walked like dancers. The sidewalks were crowded, but there was no pushing and shoving, everybody seemed to be floating on invisible waves. We European tourists looked like cripples among them. In the shops, the first thing that happened was that you were offered coffee; and for seven shillings you could have silk shirts made to measure and delivered to the ship before it departed the next day. There was an air of gaiety about the city and on the way up to Kandy, the Buddhist sanctuary, we saw elephants rolling about and playing like children in a pond. On the surface it all felt like paradise, and for the first few days crossing the Indian Ocean I thought Ceylon was where I wanted to live. But then came Australia and when I returned, almost a year later, I was homesick for Europe and wanted to get back.

1939 From Joyce to Vico and Berkeley

In the autumn of 1939 James Joyce's *Finnegans Wake* came out and the literary Dubliners – which probably made up half the population – were electrified. For seventeen years Joyce had published only bits of "Work in Progress" and he had lived in self-imposed exile in Paris for almost three decades. But Dublin had not lost interest in him. He was a constant presence in conversations. A year earlier Sam Beckett's novel *Murphy* had appeared and reminded everyone what Joyce had done for English literature.

One evening at the Glenavys, Michael MacLiammoir read the beginning and a few small sections of *Finnegans Wake*. He had an enchanting speaking voice and put on a slight Dublin accent; and everyone realized that this was the way the book should be read. The accent helped to make some of the puns comprehensible. But as there were many that involved other languages, a lot remained obscure.

Afterwards Michael, who was fluent in French and knew some Spanish, said it would be fun to get some polyglot people together to unravel a few pages. He looked at me and said:

"You speak German and Italian, why don't you try?"

"I've just come to Dublin, I only know a dozen people. You need someone who is at home here."

I looked at Will, who ran a big wholesale business. "You know hundreds of people and you know some Polish, too, don't you? Could you do it?"

He did, and so it came about that for a couple of evenings some fifteen people met, who could cover about twenty languages between them. We did not get beyond the first pages. Analyzing the puns was difficult, and the amusement to be got from them often did not seem worth the trouble of excavating it. Even so, one of them turned out to be of consequence for me. The first two lines of the book read:

"riverrun past Eve and Adam's, from swerve of shore to bend of bay, brings us by a commodius vicus of recirculation..."

Vicus is Latin for village or hamlet. What could that have to do with recirculation? The only possibility, someone said, is that it refers to the Italian philosopher Giambattista Vico, who was the first to suggest a circular theory of history in which the sequence of birth, maturation, and decay is recurrent; a forerunner of Spengler and Toynbee.

In fact, allusions to Vico occur several times in *Finnegans Wake* and as I had read Spengler's *Decline of the West*, I was intrigued and went to the Dublin library. To my great surprise I there found an old Italian edition of Vico's *New Science*. Skimming through it, I became more interested in Vico's theory of knowledge than in his views about history and I was eventually led to the epistemological treatise which he published in 1710, some thirty years before his major work. 1710 was also the year of Berkeley's first publication.

When I later read most of Berkeley's works, this coincidence intrigued me. In the years after 1710, Berkeley had been in Naples for several months, where Vico was teaching at the university. He had met Prince Doria, to whom Vico had dedicated his thesis. Is it conceivable that the two philosophers did not meet one another? I corresponded with David Berman, the Berkeley expert at Trinity College, Dublin, and he told me that there was, indeed, a notation in Berkeley's diaries saying: "Tomorrow signor Giambattista," but nothing else. There must have been quite a lot of Giambattistas in Naples at hat time and the entry could hardly be considered a proof that they met. Later, when I was teaching at the University of Georgia, I submitted a research proposal to an appropriate agency in Washington. I wanted to go to Naples during the summer to look at the archives of the Institute for Vico Studies. If any evidence of a meeting existed, it most likely would be there. But the proposal was not accepted on the grounds that Vico was an obscure philosopher and I was not member of a department of philosophy. So much for the "uni" in university.

Vico was an obscure philosopher and I was not member of a department of philosophy

Returning to *Finnegans Wake*, after the brief concerted effort to trace puns I kept the book on my bedside table. I had discovered that when you opened it when your reading was becoming unfocused because sleep was intruding in conceptual sequences, some of it suddenly seemed to make sense. But of course it was not the kind of sense you could recall later. But there was some deeper satisfaction. I don't believe anyone has the stamina to actually read much more than a page of it. We normally recognize words as a whole when we read, but here you have to read letter for letter, which is too strenuous in the long run. And who would want to merge this strange fantasy with one's dreams every night? – Joyce died two years later, profoundly disappointed in the reaction to the book he had worked on for seventeen years.

* * *

I owe it to Gordon Glenavy that I came to understand Berkeley in a way that later enabled me to connect some of his explanations with the ideas of Silvio Ceccato and Jean Piaget. At the very beginning of his treatise on *The Principles of Human Understanding*, Berkeley writes that he finds all that has been said about "being" and "existence" wholly incomprehensible. We have tables, houses, trees, and a myriad other things in our perception, but where these things should reside when we are not perceiving them is quite unfathomable to him. This led many of his readers to the question whether or not a tree falling in the forest made a sound. The answer to this question is another question: What is sound? Surely sound is primarily a perception. What we perceive is what we see, hear, feel, taste, and smell. That it should exist, so as we perceive it, outside our perception, is an assumption that cannot be confirmed in any way. Physicists tell us that it is waves in a medium – but waves by themselves make no sound.

As I told Isabel what I had learned from Gordon, she said that she had long been waiting for such an explanation.

"I never told you, that my mother had me take religion lessons in Sydney before we moved to Paris. An old woman friend, whom she trusted a lot, advised her to do it. When your daughter grows up, she said, and doesn't need it, she'll have no difficulty getting rid of it; and if she finds it helpful, she'll have a basis to build on. My mother found this reasonable and so I learned a bit of religious history. One of the very few details I remember, is that Martin Luther somewhere crashed his fist on the table and shouted 'est, est, est!' when the question arose, whether the wine drunk at communion is or is not actually the blood of Christ. I found this both cannibalistic and incomprehensible. What could 'being' mean in that context? The wine in the bottle was the wine in the bottle. Perhaps one could pretend it were blood, but this was a fantasy and surely could not be covered by the *mystical concept of being*."

I put my arms round her and told her that she was simply wonderful.

1970 Lana, the almost literate chimp

Charles Darby lived just a few houses up the street from ours and after Isabel died he and Barbara were among the few people I saw fairly frequently. One evening at his house, he introduced me to Ray Carpenter, one of the fathers of primatology in the United States. I had a great time talking with him because he was interested not only in apes but also in computers and wanted to hear all about our language analysis project. He had the background knowledge to understand what we were trying to do and he seemed sincerely interested. Later that evening, when we were leaving, he asked me if I played golf and I said that I was just beginning to take it up again.

"I'm not very good at it," he said, "but I like the exercise. Maybe you'll play with me some Saturday?"

I'd be delighted, I told him; all he would have to do was call me during the week.

He was, indeed, not a good player. But he liked the leisurely talks one could have walking on a pleasant surface and I liked listening to him. He was somewhat cranky and autocratic, but given his wide range of interests, he was hardly ever boring. Our Saturdays almost became a regular feature. When my research contract with the Air Force came to its abrupt end I appreciated his sympathy. It was all a question of money, he said. Ten years ago, Army, Navy, and Air Force were swimming in research money and had difficulty spending it all. That's why they were able to sponsor projects that had no direct connection to military matters. When Nixon became president, budgets were tightened in a spurious economy drive and the agencies had to limit their sponsorship to the strictly military.

One Saturday, later that spring, Carpenter came with an intriguing idea. The Yerkes Center in Atlanta, the first and foremost institute of primate research, was planning to investigate the possibility of communication between humans and great apes through a computer by means of a visual language. The great apes (gorillas, orangutans, chimpanzees), he explained, did not have the physical capability to modulate sounds very much and therefore would probably never learn a spoken language. But they were quick and clever with their fingers and Alan and Beatrice Gardner had successfully taught the American sign-language, the language used by the deaf and dumb, to a chimpanzee called Washoe. Washoe was in the process of becoming world famous. Linguists were in turmoil, because most of them wanted to believe with Chomsky that language was a human prerogative. Sign language, they said, did not have a proper syntax and therefore wasn't really a language. The Gardners, they suggested, were like parents with their baby: they saw and heard things that no one else could see or hear.

The Yerkes plan was to build a communication system with a simplified language, a keyboard, and a small computer. The computer would record everything the chimp typed on the keyboard and there would be no subjective bias as to what the chimp had or had not typed.

It seemed a great idea to me and when Carpenter asked me if I would like to design the special language and the computer system, I didn't hesitate to say yes. My only condition was that Piero Pisani would be part of the team because, although I had had a hand in designing computer procedures, I was not a programmer.

Before the end of the following week, I received a call from the Yerkes Center asking me and Piero to come to a discussion of the "Language Project." As far as the two of us were concerned, the meeting was a great success. The Yerkes Center would buy part of our working time from the University of Georgia (which I liked because it meant less teaching whenever I would be asked to give courses) and we would be completely on our own with regard to the design of the language and the computer program. At the end of the meeting we were introduced to the subjects of the research, which had already been chosen: a one-year old female chimpanzee called Lana and a female orangutan of the same age. I was instantly seduced by the orangutan's calm, soulful eyes that looked at me as she gently grasped a finger of my outstretched hand. It was as though she were sizing me up, far more knowing and thoughtful than a human infant. Lana, on the other hand was all action, with no indication of reflection, rather like a hyperactive child. Indeed, it soon became clear that they could not be taught together. Whatever gadget was shown to them, Lana would instantly appropriate it and consider it hers, while the orangutan would calmly sit and watch, as though she were trying to understand before touching. They would have needed separate treatment and therefore separate projects. The Yerkes people, who had far more experience with chimps, therefore decided to drop the orangutan and work with Lana only.

> I wanted to find out how Lana organized her experiential reality

We had many more meetings to establish the details of the planned setup. A Plexiglas cubicle the size of a small room was to be built onto an existing wall that had a window to the outside. One of the Plexiglas walls was to be dedicated to the keyboard, a square unit of 25 keys, and there would be space for other units to be added as Lana got more proficient. Below the keyboard was a row of dispensers, activated through the computer; they would provide all sorts of food and it was hoped that Lana would learn to feed herself by means of requests typed on the keyboard. The dispensers could provide slices of banana and of apple, monkey chow, milk, and water, and there was the provision that, through the keyboard, she could ask for music or a film of primates in the wild to be projected. She could also request the curtain at the window to be drawn up or down.

Above the keyboard would be a sturdy horizontal bar that Lana had to hang onto in order to switch on the system. This was to keep one of her hands busy, so that she could not use both to press keys simultaneously.

It was expected that it would take several months to teach her to press keys, and it did. This was fortunate, because it gave me and Piero time to design the language and the program for the computer. Piero produced what in my view was his greatest achievement: he managed to squeeze a miniature replica of the system we had used in the Air Force project – a system that was based on 28,000 instructions – plus the necessary command module for the dispensers into the 4,000 machine-word memory of the small computer we were to use.

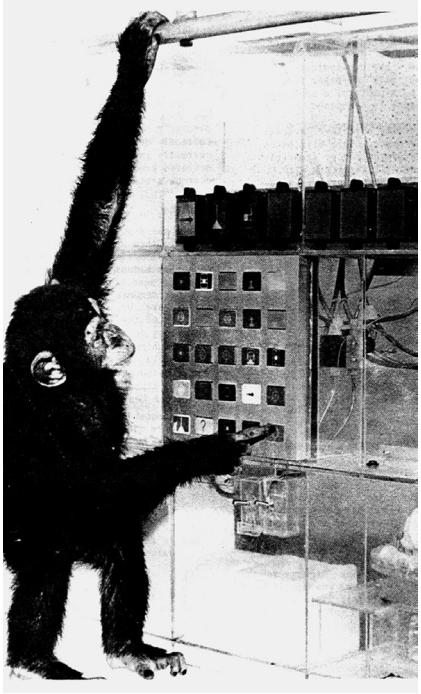
With the help of the primatologists I made a list of things that would presumably interest a young chimpanzee and could be available in the project. They were over a hundred. Twenty-five were to be put on the first panel of keys. Each key was to have an abstract design representing not a letter but the "word-design" for a single concept. I called these word-designs "lexigrams." Seven was the maximum length of a sentence. I wanted to use non-representational designs to emphasize their symbol-character and to prevent critical linguists from saying that Lana recognized them because they were just familiar pictures. It seemed a simple enough task, but there was a complication. Whenever Lana pressed a key, the respective lexigram had to be projected in a row of windows above the keyboard, one after the other from left to right. This would help Lana to see how far along she was in typing the sentence. It was necessary, too, so that messages could be sent from a keyboard outside Lana's cubicle for her to read.

Hal Warner, the in-house engineer at Yerkes, found the technical solution of the problem. Ten little projectors would contain simple design elements and project them as needed into the little windows above the keyboard. The lexigrams, consequently, had to be combinations of very simple design elements. I tried all sorts of basic geometrical figures looking for a set that provided the greatest variety of combinatorial possibilities. I used Charlotte as guinea pig. As an artist, I thought, she would be a good judge of which combinations were easiest to discriminate from one another. She turned out to be a great help: Lana never confused lexigrams. I formulated the rules of a primitive syntax that would govern which lexigram sequences (i.e. sentences) were to be considered correct and which mistaken. There were three classes of message: statements, requests, and questions. Requests were differentiated from the others by first pressing a key we called "please"; questions had to begin with a question mark; and in order to know when to check the correctness of Lana's typing the computer needed a signal to indicate the end of a sentence, like a period.

Lana's training began with a panel of three or four keys, which enabled her to learn in the good old "stimulus/response" fashion that if she typed "Please give raisin," she would indeed be given a raisin. Then the configuration of the keys in the panel was changed, and she had to learn that it was the sequence of lexigrams that counted, not their position in the panel. She also had to learn that it was always necessary to press the period key at the end of a sentence. It took about four months and it was hard work for Lana and the graduate students who every day spent several hours with her. But once she had learned these preliminaries, her progress was much faster than expected. When she got the first 25-lexigram panel, she quickly learned to watch the row of windows above the keyboard to check what she had typed. It took her no time to find out that when she had made a typing error she could erase what she had typed by pressing the period key. This made the computer cancel the input because it contained an error; and it saved Lana the time it would have taken to finish typing an invalid sentence. This, I thought, was a good first demonstration that Lana's brain was capable of reflection.

In the five years that I was involved in the Lana project she made it quite clear that she understood the principle of symbolic communication, i.e., that by using symbols she could have some influence on what she was experiencing. Unfortunately the director of the project was still greatly hampered by the behaviorist doctrine that shunned the use of "mentalistic" notions such as meaning, purpose, and intention. In order to provide statistical evidence of her "skills," Lana was subjected to repetitive tests like a rat in a maze. The results were dismal. Because she was not kept starving, like the animals in Skinner boxes, she did not care about the reinforcement if the same problem was repeated four or five times. Like a human child she lost interest and pressed keys without looking. Her statistics therefore tended to be worse than those of rats.

On the other hand, she did things that no rat could do. When Tim, the graduate student who worked with her in these experiments, repeated the same question for the nth time, she typed: "Please Tim move out-of room." This was above all remarkable because Lana had encountered expressions such as "out-of," "in-front-of," and "behind" only in the context of boxes and wooden blocks on a table and the notion that her room was a kind of box you could "move out of" was entirely her own.



Lana at her keyboard.

For conventional experimental psychologists such a reply, a repetition of which could not be forced by the experimenter, was purely "anecdotal" and had no scientific value. The fact that understanding in communication could not be tested statistically but shown only by the appropriateness of individual reactions or utterances, was not and, I believe, is still not wholly accepted by the profession. Consequently most of the things that persuaded me that Lana was well able to communicate by means of symbols did not cut any ice with the critics.

There were quite a few other examples of original, spontaneous, and appropriate utterances, but I'll recount only the one that I consider the most sophisticated. Among the things she could request were slices of banana. As bananas tend to be sticky, it happened that the arm of the dispenser that was to deliver them got stuck. One morning when Shelley, another graduate student, who regularly worked with her, appeared outside the Plexiglas cubicle, Lana, instead of waiting for Shelley to come into the cu-

bicle to provide the day's first tickle, rushed to the keyboard and typed: "Please Shelley move behind room." It was a phrase that had never cropped up and Shelley had no idea what it could mean. Lana threw up both her arms in an unmistakable human gesture of despair (presumably acquired by observing her human keepers) and once more typed the same phrase. At that point Shelley happened to look at the array of dispensers and noticed that the one for slices of banana had got stuck. She went out of the cubicle and to the other side of the transparent wall – which from Lana's point of view could quite reasonably be called "behind room." Lana watched her clear the dispenser and immediately typed: "Please machine give piece-of banana."

Once I realized that Lana was indeed capable of forming concepts, I began to wonder to what extent they functioned like ours. I had some ideas of tests that might throw light on this question. Could Lana, for example, correctly answer: "Are bananas blue?" when there was no banana in sight. A correct answer of "no" would require a mental representation of banana that was independent of actual perception. I was also curious whether Lana classified objects and whether her classes were similar to the ones we tend to form. In short, as I was already deep into constructivism, I wanted to find out how Lana organized her experiential reality. There were obviously some solid parallels, but I thought it likely that there would also be differences (not as many, of course, as with a chimp who had grown up in the wild).

Though I mentioned the banana test to the director, there never seemed to be time to fit it into the schedule of experiments. Then, when a renewal of the contract with the sponsoring agency came up, there was the idea to try out the symbol keyboard and the computer system with autistic children. From what was known about them at the time, it seemed likely that they would become interested. I was enthusiastic about the idea and, with the help of Piero Pisani, I drafted a part of the proposal, adding a capability to the system that seemed essential to me: when the child pressed a lexigram key, a recorded voice would speak the English word through a loudspeaker. I saw no point in trying to teach an autistic child a symbolic communication system that did not in some way lead to the language she was to use later.

When we were shown the final draft of the proposal, the voice-part was left out. It would have added eight or nine thousand dollars to the total requested. It was too much, they said. The total was about a quarter of a million. I was furious and, as Piero had had his own disagreements with the direction, we decided to leave the project. The ironical sequel was that less than a year later the project director married a young cognitive psychologist who then did excellent work in the area of animal cognition.

1972 Teaching psychology

I had been hired as "research associate" by the Psychology Department of the University of Georgia, and this meant that my contract had to be renewed every year. In my second year, Charles Darby suggested that they make me "assistant professor" which would give me about seven years to work for a promotion to "associate professor" and greater security. It was not explicitly said, but I realized that as assistant "prof" I would not get away without teaching, but I thought I had better risk it.

The reason the department had taken me in in the first place was that they had no one who could teach anything about language, and that happened to be my expertise. Now, of course, they realized that this was not enough to teach introductory undergraduate courses in psychology; and in a way this saved me. I was scheduled to teach graduate courses of my choosing and co-teach introductory courses with another member of the department, and one third of my time was reserved for research. In the long run, this suited me very well. My co-teaching consisted in giving a few lectures on language and language acquisition at the right moment in a colleague's introductory course. At the beginning, this, of course, was terrifying because like every novice, no matter how many notes I prepared, I ran out of steam halfway through the allotted time. But after a few moments of panic, I learned to pace myself. With the graduate course it was much easier, because once you had assembled a suitable reading list, the course could be turned into a discussion, which you could start by asking the students about how they interpreted what they had read. And it was not too difficult to formulate the questions so that they were led to think along more adequate lines.

The teacher's role, I realized after a few years, had something in common with that of the dog that is indispensable when you have to drive cattle from one place to another in Ireland. The country roads there are separated from the fields by hedges; but every now and then the hedges have gaps to allow the farmer to get into the field with a cart. If you are alone, driving a few cows down such a road is impossible. You have to stay behind the animals to urge them on, and when the first cow comes to a gap in the hedge, she inevitably sees the nice grass in the field and goes through the gap. The others, of course, are only too happy to follow – and once the five or six cows are scattered in the field you have no way of getting them back on the road. That is where the dog comes in. With a little training he knows what to do. He stays ahead of the cows and when he sees a gap in the hedge, he just stands in it and barks until the cows have passed. A teacher cannot know where the students are going. He cannot give them what he would like them to think, but thanks to language he can stop trains of thought that he considers unhelpful. Maturana called this the orienting function of language.

The teacher's role has something in common with that of the dog that is indispensable when you have to drive cattle from one place to another

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When I became involved in the chimpanzee research at the Yerkes Center in Atlanta, this paid for another third of my time, so that I had to teach only one course per quarter. When I resigned from the Lana project, my colleague Charlie Smock asked me to join the Georgia Follow Through Program and the research on children's development of mathematical concepts became a replacement of the chimp research. I had

no idea that this new focus of interest was going to determine my future. Throughout my time at the University of Georgia I was able to have external research projects that relieved me of one third of my teaching obligation.

It was Charlie Smock who introduced me to the theoretical world of Jean Piaget. Years before, when I was working at the Center of Cybernetics in Milan, I had read a reference to Piaget and had asked Ceccato about it. Don't bother, Ceccato said, he is interested in children. They had met several times and Piaget had made Ceccato one of the editors of his series of *Epistemological Studies*, a long chain of publications in which the various branches of Piaget's theory were described in great detail. I don't think Ceccato ever read any of them. He had taken an instant dislike to the man. In a way, this was a tragedy, because although Ceccato's ideas pertained to a lower level of analysis, they fitted well with Piaget's notions about cognitive development. The two could have been of great help to one another. I realized this when I started reading the many original Piaget publications that Smock had collected during his years at Geneva and I am eternally grateful to him for having given them to me.

Many times when I tried to explain some idea of mine to Smock, he would tell me that it was exactly what Piaget had said. This was a big encouragement for me and I avidly read the French texts. They greatly enriched my thinking and, no less important, provided a vocabulary that was comfortable for me to use.

* * *

From both the Charles (Darby and Smock) I got valuable tips about how to supervise students' master theses and dissertations. It was a very worth-while activity and I learned an enormous amount in my own way of thinking from the graduate students I had the privilege of teaching. The reason is that, once they have realized that you don't mind questions, they will ask about anything they don't understand. Your colleagues, who listen to talks you give in the department or at conferences elsewhere, are extremely reluctant to discuss things about which they themselves are not quite certain. Students' questions, on the other hand, often draw your attention to things that you have not expressed adequately or to holes in your reasoning. And the actual research they carry out under your guidance is often as much of a benefit to you as to them.

The research, for example, that Michael Tomasello and his wife did on the language acquisition of their daughter during the second year of her life not only provided him with a master's thesis as well as a doctoral dissertation, but was also of enormous value to me in that it supplied me with additional experiential material to underpin Piaget's theory of development.

Michael's PhD also did something for me of which I did not immediately become aware. Shortly after his graduation he got a job in the psychology department of Emory University in Atlanta. I was pleased because it meant that interaction with him would continue a little longer, but it did not strike me as unusual. After a few weeks, however, one of my colleagues took me aside and asked whether I had noticed that some of the behaviorists in the department had changed their opinion of me. I couldn't say that I had; but he explained that Emory was a private school and considered far more exclusive than Georgia University. No student of ours had ever got a job there. Your student now has, he said, therefore your colleagues think that you may be a professor of psychology after all.

> If the river were conscious of its flowing, it still could never get to know the landscape

1973 Language and Thought

Through Charlie Smock I came into contact with Les Steffe in the School of Education, who directed research on how to teach mathematics. He was intrigued by my ideas about language and asked me to join him in a project on children's acquisition of the concept of number. It was the beginning of a collaboration that lasted more than two decades and at once forced me to organize, formulate, and in some way justify thoughts I had been playing with for a long time.

Growing up with several languages, rather than with one, is fundamentally different from learning them in school or with the help of a primer. Growing into a language means that you pick it up in situations through which you are living, building up the meaning of words on the basis of what you are actually experiencing. When the teacher in a French lesson explains the meaning of a French word, or when you read its definition in a bilingual dictionary, the concepts the words of the explanation call up in you are inevitably concepts that you formed in the context of speaking English. They are frequently different from those a French child learned to form in his or her interactions with native speakers of French.

Living in more than one language, you cannot help becoming aware of the conceptual differences. The worlds described by different languages are hardly ever quite the same and sooner or later you stumble on the question which of your languages gives the right picture. It did not take me long to realize that this was a silly question. For a native speaker of English, the world English depicts is the only one he or she knows and there is no reason to suspect that it might not be the only one. Of course, one's friends and enemies sometimes see things differently, too, but one explains this as a matter of perspective (or stupidity) and it does not suggest that they see a different world.

Years of daily interaction with the speakers of different languages provide sufficient evidence that the worlds they live in are not identical. They are close enough for much of what they know to be compatible, but that does not mean that their worlds have to be the same.

It was this realization that triggered my life-long preoccupation with the theory of knowledge. My readings started with Wittgenstein's *Tractatus* and were accidentally directed by Joyce's *Finnegans Wake* to the Italian 18th-century philosopher Vico, who said that to know something means to know how it has been put together. This gave me the notion of construction that became the core of my thinking. It gave me a fruitful way of reading the Irish philosopher George Berkeley, to whom Gordon Glenavy introduced me, and it proved eminently compatible with the teachings of Ceccato with whom in one way or another I worked for almost twenty years. When I came to the

THE AUTHOR

Ernst von Glasersfeld was born in Munich, 1917, of Austrian parents, and grew up in Northern Italy and Switzerland. Briefly studied mathematics in Zürich and Vienna. Returned to Italy in 1946, worked as journalist, and collaborated until 1961 in Ceccato's *Scuola Operativa Italiana* (language analysis and machine translation). From 1962 director of US-sponsored research project in computational linguistics. From 1970, he taught cognitive psychology at the University of Georgia, USA. Professor Emeritus, 1987. Several honorary doctorates.
Recent publication: *Key Works in Radical Constructivism* (2007).
Web site: http://www.vonglasersfeld.com

United States and studied the works of Jean Piaget, I found that he had called his approach to children's cognitive processes and acquisition of knowledge "constructivism."

Piaget's statement that the mind organizes the world by organizing itself became the leading principle of my endeavors and much of my work consists in going to the roots of ideas that he left implicit – which is why I called it "radical constructivism."

With the notion of the mind organizing itself and its search for equilibrium, Piaget had anticipated the main concepts of cybernetics and I made it my business to interpret him from that position. A useful metaphor for the way we build up what we know is the course of a river. Its bed, that is where and how it flows, is carved out of the landscape by the force of the water and the fact that it cannot flow uphill. It is a cybernetic process in that it constantly generates a labile equilibrium between the force of the water and the constraints of the landscape. If the river were conscious of its flowing, it still could never get to know the landscape. It would become aware only of impediments to its progress. Thus I believe, as the sceptics have proclaimed for almost three thousand years, that we cannot come to know "reality," that is, a world as it might exist independently of us; we can only construct a more or less stable model of a world in the domain of our experience. How this experience is caused by something that lies beyond it cannot be grasped by our reason and must therefore remain the playground of mystics and metaphysicians.

I have often been accused of solipsism, that is the denial of a reality existing by itself. It's an accusation made by people who have not paid much attention to what I have said or written. I hold with Berkeley, who said that we cannot possibly know what the word "to be" or "to exist" should mean outside the domain of experience. I therefore profess agnosticism with regard to reality, but I do not deny it. The theory of knowledge I have developed is an attempt to show that all we know by way of reason can be built up from elements that we ourselves experience.

1978 Reflections on time and space

On some of my trips to Dublin, after we had settled in the United States, I visited David Berman, who taught philosophy at Trinity College, and I think it was he who suggested I look at some of the papers of the Irish mathematician William Rowan Hamilton which were in the Trinity Library. Most of them treated a level of mathematics that was well above my head. But I came across one that was philosophical and contained no formulas. I was attracted by its title: "Algebra as the Science of Pure Time." I found in it an invaluable hint about the conceptual construction of time.

Hamilton makes the startling observation that the concept of time is the result of projecting one series of experiences onto another. I thought it was startling, because unlike the modern physicists, who say that time began with the Big Bang, which gives it an independent existence, Hamilton suggested that it had to be conceived by a thinker, that is, some agent that deliberately projects and relates. Except for Wittgenstein, who casually mentions the same idea in his *Tractatus*, I don't know anyone else who shared it.

Berkeley, of course, said that time is "a thing of the mind" and Piaget makes the generic remark that "Time is nothing but the interrelating of the events that it contains." I agree, but this is not specific enough. I wanted to know how one could come to have the concept of time and was intrigued by the notion of projection. So I started from Hamilton's assertion and tried to think of how the projection of experiences he speaks of could be implemented in practice. A discussion with Charlotte's daughter Lisa, who is a dancer and very much aware of the problem of translating sensations into movement and vice versa, was of great help. For the notion of projection she immediately had a variety of applications, but what I needed was a way to describe what one had to do to "project." I suggested looking at the frame of the window in front of us and imagining beside it a vertical yard stick marked in feet. We noticed that our attention was either on the window frame or on the yard stick but could not be on both at once. We could, however, superimpose the attentional pattern of the one on the other; that is to say, you could begin to see the window frame divided into the sections of the yard stick, or conversely, the yard stick, disregarding the marks on it, as an unbroken whole. In other words, we were able to superimpose a different attentional pattern on an actual experience. This gave me an imaginable application of the kind of projection Hamilton had spoken of.

One night, lying in bed, I was scratching a mosquito bite on my left arm and it struck me that this was giving rise to two parallel experiences, between which attention can shift to and fro, like between the window frame and the yard stick. It seemed a prom-

ising idea and I played with it for several days. This is what I ended up with.

Rub one finger of your right hand on the bare skin of your left arm, from the wrist to the elbow. You have two sequences of sensation: one single source in your finger signals an unbroken repetition of contacts. In your arm, instead, a number of different sources signal points of contact with something. (Note that the sources by themselves cannot tell you what the contact is with.)

At first you may not find it easy to separate the two sources of sensation; but if you try it in bed, when the room is dark and there are practically no other perceptions, you will succeed.

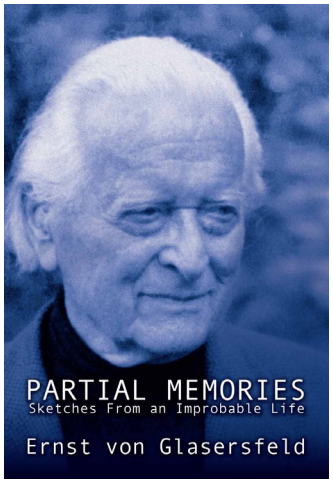
In your finger, the point of origin remains the same, but in your arm, the point of origin changes. In both cases there is a sequence of experiences that come one after the other. These sequences are not the result of a medium that flows and passes, a medium like a river that carries experiences in and out of your awareness. The sequences are the result of the fact that experiences have to follow one upon the other because you cannot be aware of two experiences at once.

In the little experiment in bed you become aware of a succession of touched spots on your arm and of a repetition of contact made by your finger. These experiences differ in more than the places of origin. The sensations originating in the arm are perceived as qualitatively similar – a signal that something is touching the arm. As sensations they are not distinguished and therefore cannot, on this first level of abstraction, constitute a plurality. They are merged into a continuity. The sensations from the finger, in contrast, are not all quite the same, because of unevenness or hairs on the surface of the arm. Hence they tend to remain a succession.

This difference is crucial when the one sequence of sensations is projected onto the other. If a succession of discrete experiences is projected onto a continuity, the items of the succession articulate the continuity into discrete segments, each of which covers a certain stretch that can now be seen as 'duration,' i.e. a portion of time. If, on the other hand, a continuity of experience is projected on a sequence of sensations, what leads from one sensation to the next can be seen as 'extension' and what separates them as space.

This can now be summarized: If an uninterrupted succession of differing sensations from one and the same source is linked to form a continuity, it gives rise to the concept of time; if, in contrast, a sequence of similar sensations from different sources is linked, it generates the concept of space.

If you accept this "explanation," it becomes clear that to say "time goes by" is not even a metaphor, it is a useless fiction. Time does not move, it's our experiences that, following one upon the other, necessarily pass.



"Partial Memories: Sketches from an Improbable Life" by Ernst von Glasersfeld With an afterword by Josef Mitterer Imprint-Academic, London, 2010 ISBN 978-1845401863 266 pages